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on behalf of the Uppsala HEP group

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Collider based particle physics at Uppsala University

Partikeldagarna, October 16-17th 2008

C. Bélanger- Champagne, N. Bingefors, R. Brenner, C. Buszello, E. Coniavitis, T. Ekelöf, M. Ellert, A. Ferrari, M. Flechl, C. Isaksson J. Jönemo, L.E. Lindquist, B. Mohn, Roger Ruber, Volker Ziemann

SweGrid

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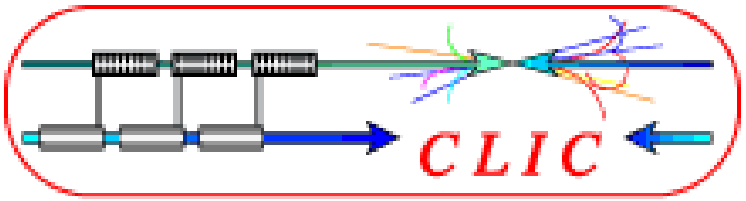

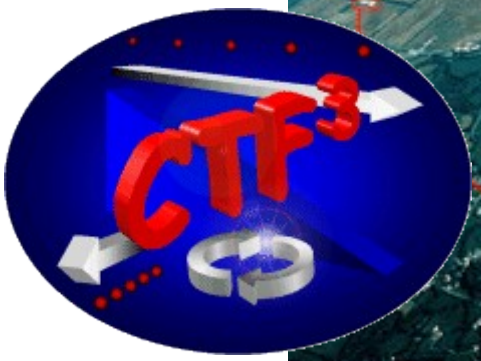

NOT in this presentation

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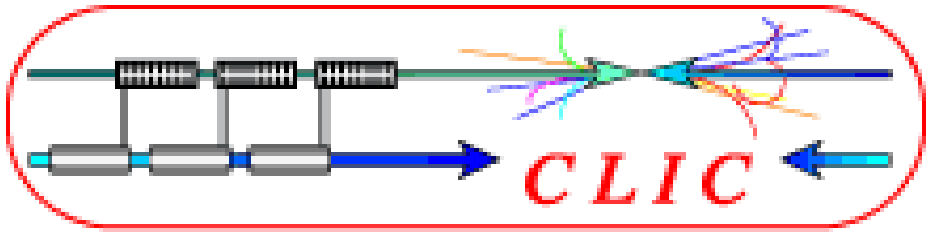
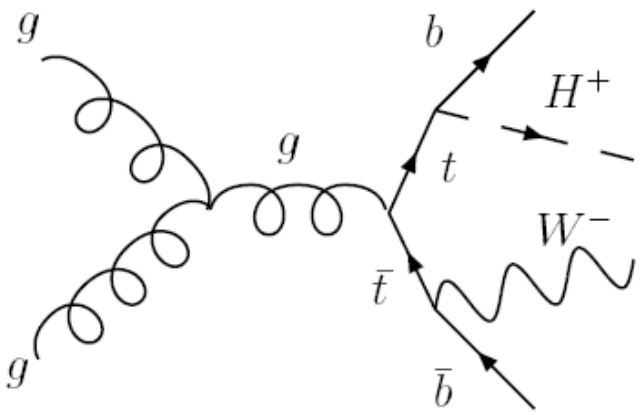
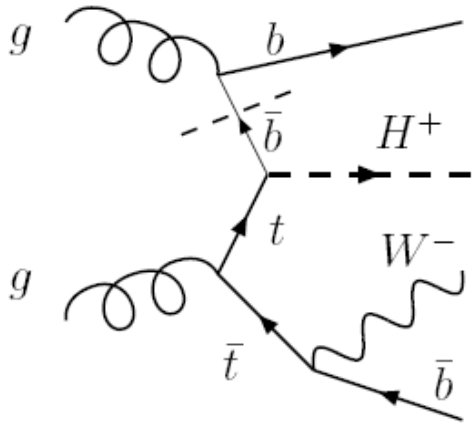
- The Matrix Element Method at DØ as a direct search method for a charged Higgs boson
  - Camille Belanger-Champagne
- CLIC Presentation
  - Volker Ziemann
- EuroTeV Presentation
  - Arnaud Ferrari



Physics focus: Charged Higgs

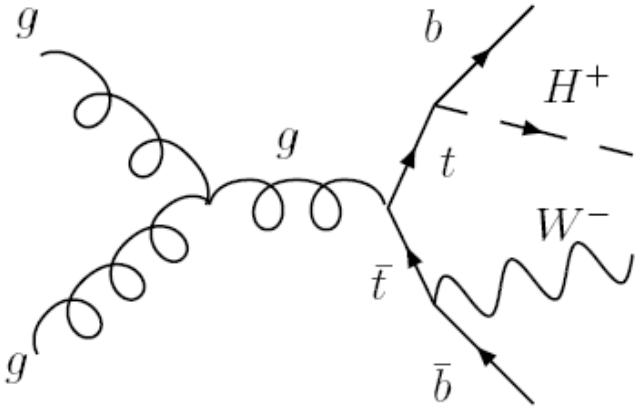
- Chances for an unaltered SM Higgs sector getting quite slim.
  - CP violation
  - Dark matter
- Two Higgs doublets (e.g SUSY)
  => Charged Higgs

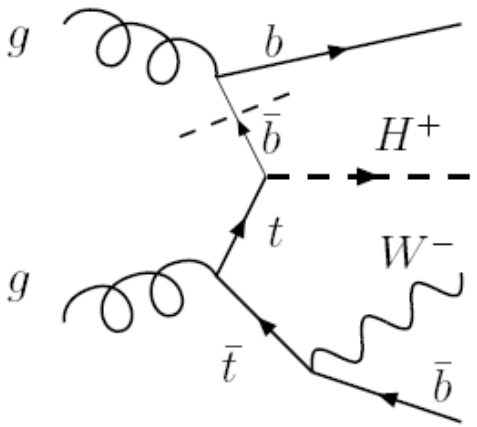




Physics Overview

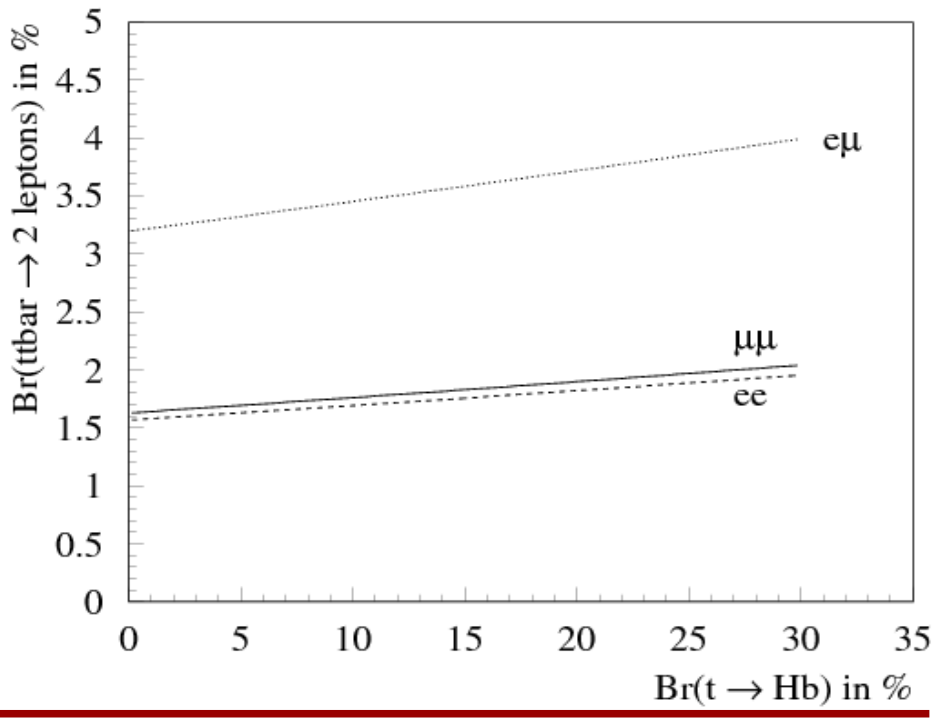
- Staggered plan:
  - Indirect searches at DØ, then ATLAS
  - Direct search in suitable modes when they become statistically feasible
    - $m_H < m_t$: top pair decays
    - $m_H > m_t$: bottom top fusion
    - H^+ decay to τ (hadronic τ decay)
- Obvious consequences:
  - Trigger on τ => τ trigger studies
  - Need to understand top pair production ... as signal *and* background
  - Prepare for the SLHC (... CLIC)





Indirect H^+ searches

- Very similar pattern:
  - $tt \rightarrow W^+bW^-b \rightarrow ll\ bb\ w$
  - $tt \rightarrow H^+bW^-b \rightarrow \tau l\ bb\ w$
- $H^+ \rightarrow \tau \rightarrow l$ decays more frequent than $W^+ \rightarrow l$



- Using hadronic τ decays:

  Get relative $tt \rightarrow \tau l\ X / tt \rightarrow ll\ X$ cross sections

  ... figure in leptonic τ decays

  ... look for an excess of τ or set a limit

D0: Statistics ⟷ ATLAS: Systematics

The H^+ CSC effort

- Start June 2006; now at the end of the publication process
- For the first time: Simulation studies of all of the most promising H^+ channels with
  - a realistic detector simulation
  - full consideration of all trigger levels
  - inclusion of dominating systematic uncertainties
  - in a common framework
- Aim: To get the machinery ready for first data
- More than 20 people from about a dozen of institutions directly involved

Direct H^+ searches – CSC results

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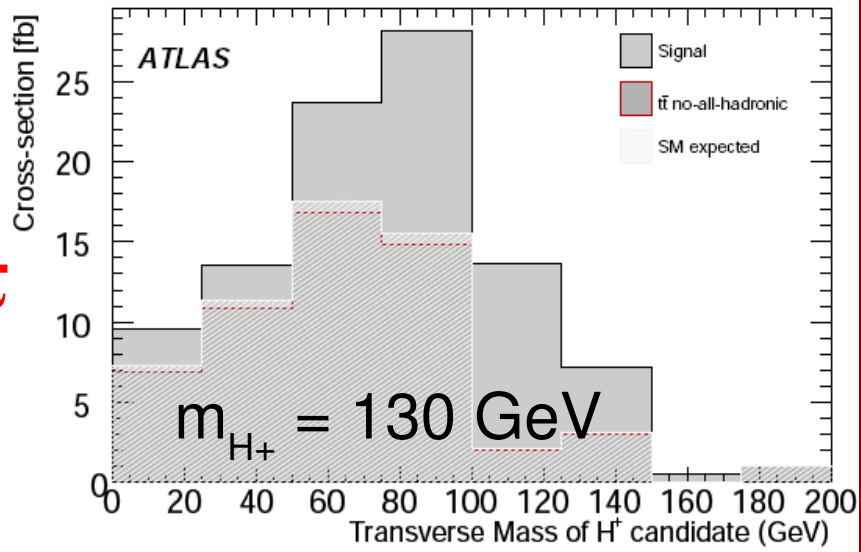
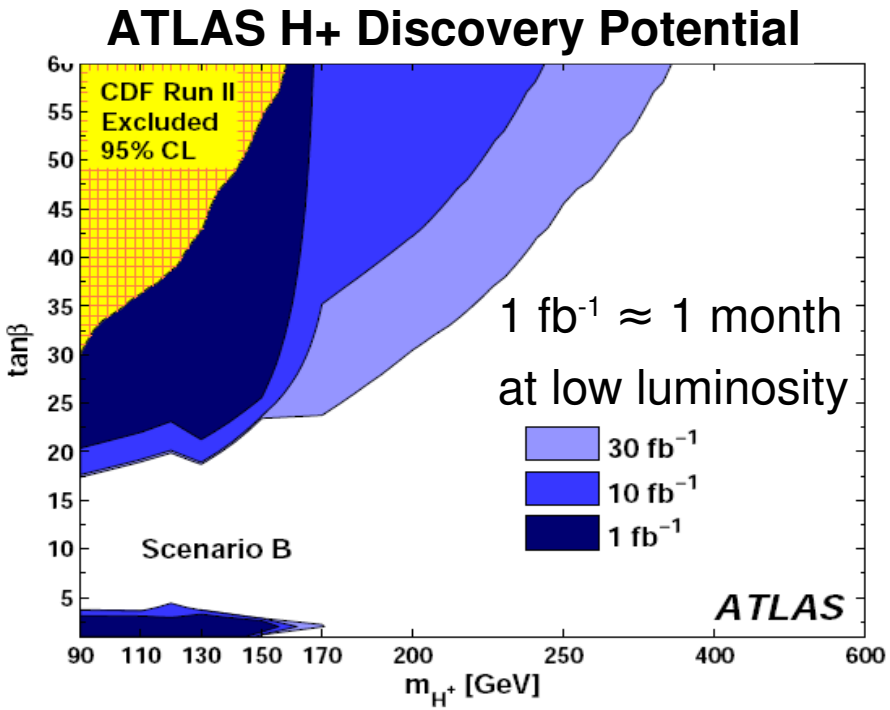
- Channels studied in Uppsala:

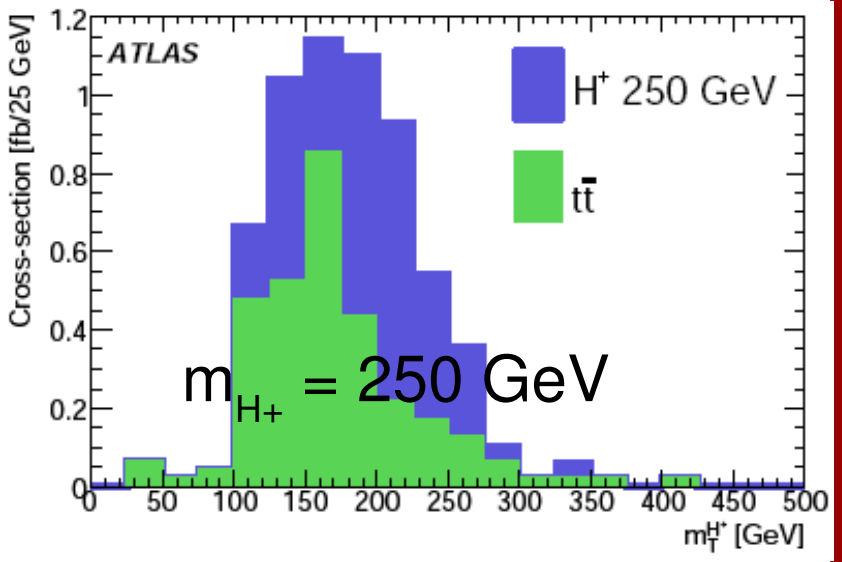
  "Light": $tt \rightarrow bWbH^+ \rightarrow bqqb\nu\tau$

  "Heavy": $gg/gb \rightarrow t[b]H^+ \rightarrow [b]bqq\nu\tau$

- Next, isolate critical issues ...







Tau identification in busy events

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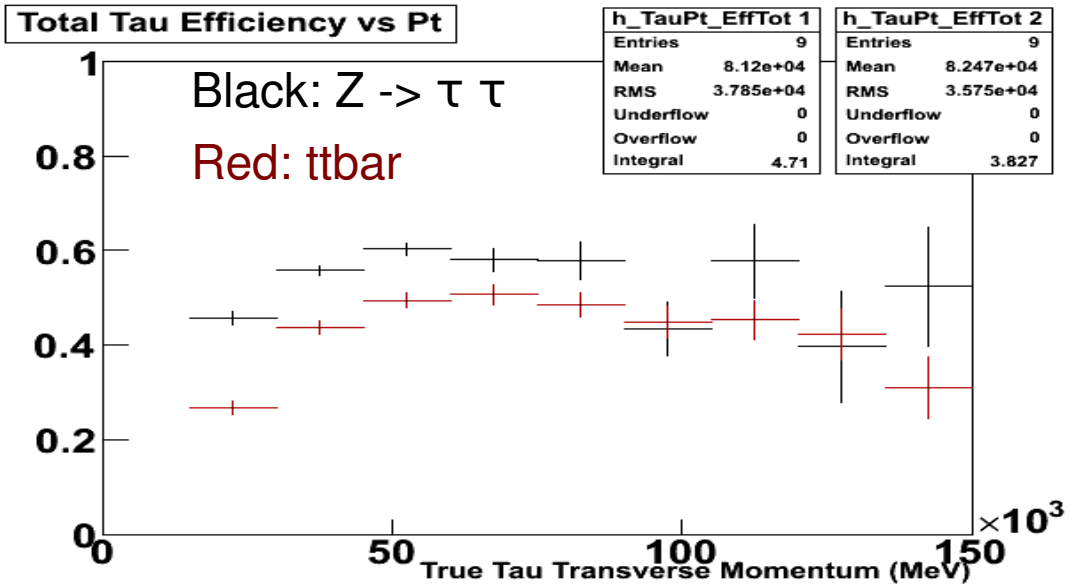
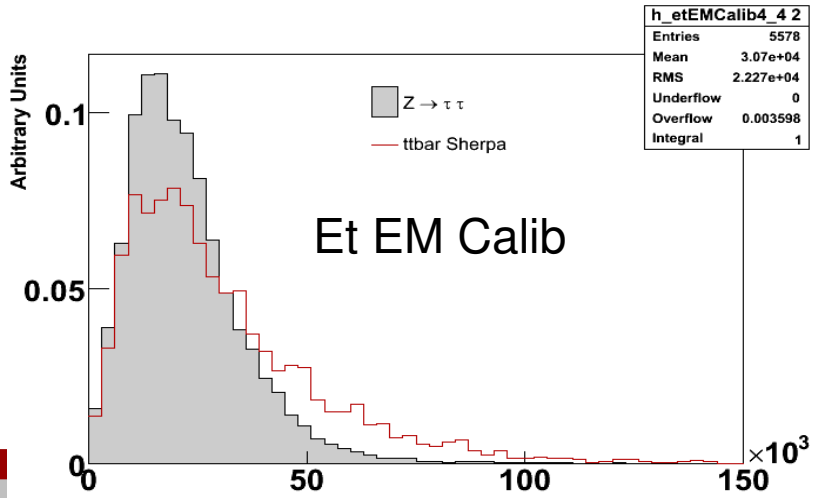
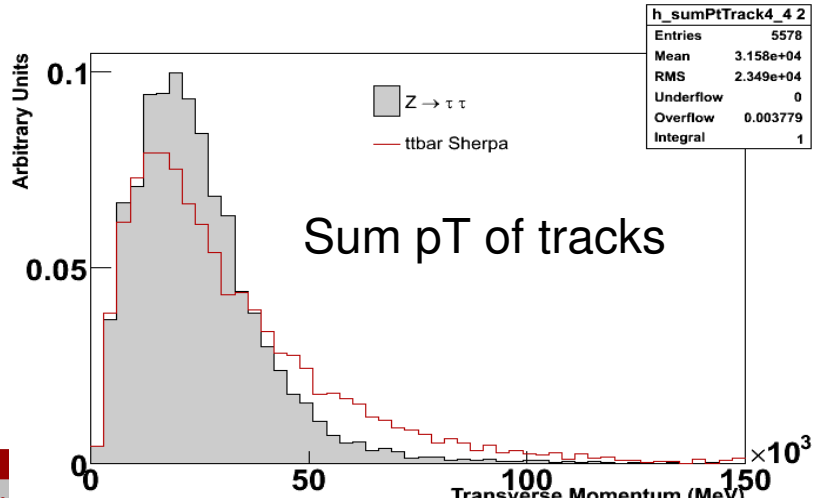
Is tau ID influenced by the busier environment in ttbar events?



=> Study critical variables and possibly optimise likelihood for busy envents:





Top pair background modeling

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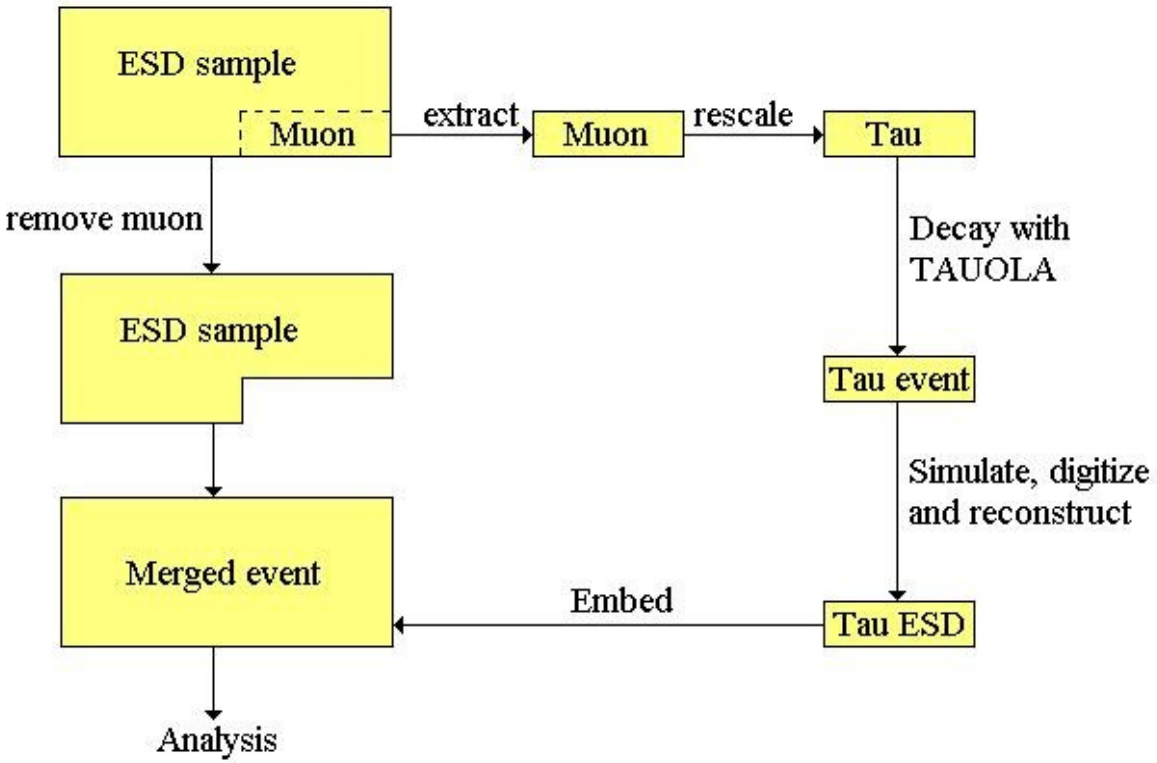
Want to extract bkg info from data (Reduce systematics)

Idea: Replace μ in real tt-bar data sample with simulated τ



- Replace calorimeter cells around muons in the original ttbar→μμ+X event with cells from the τ- decay event.
- Original muon tracks are replaced with tracks from the τ- decay event.
- The data is then run through reconstruction again to produce the final ttbar→τ τ →μμ control sample

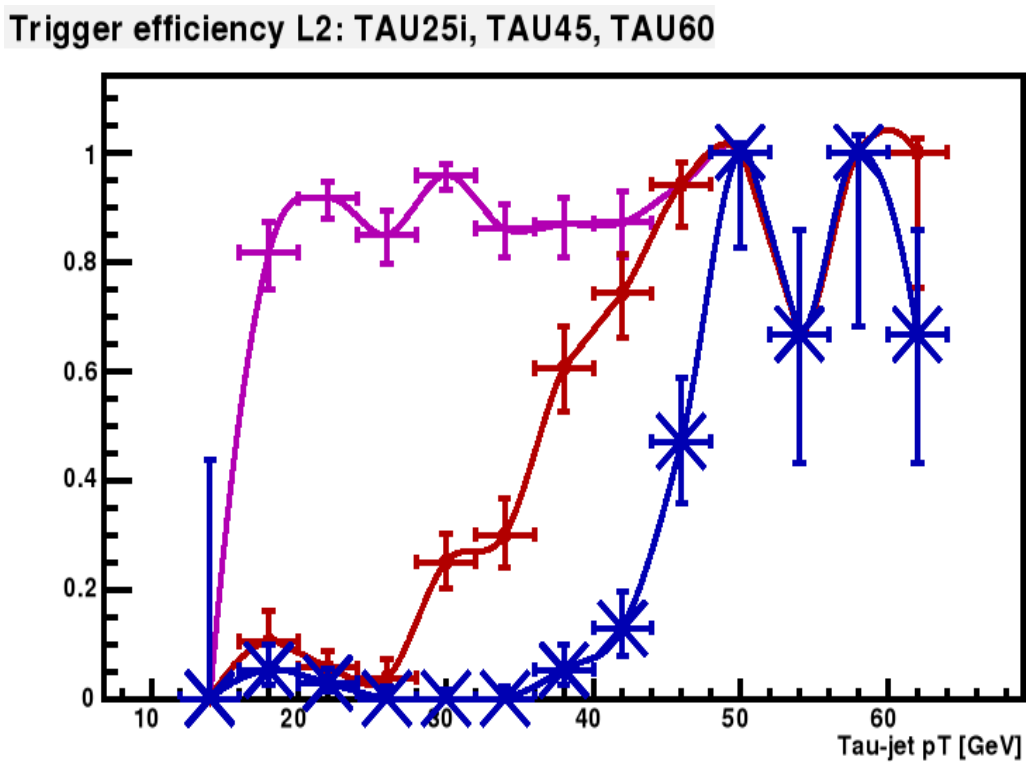
✓Machinery is set up. Next steps:

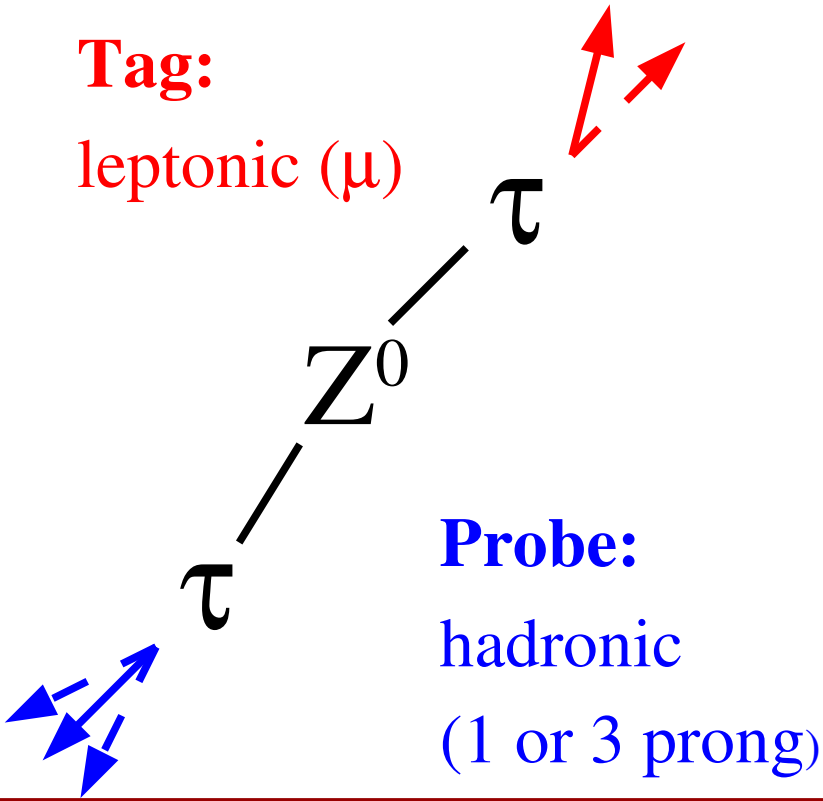
Make sure the methods works as expected and try to understand/tune the details

Optimize selection of ttbar(μ)-events for high purity

Tau trigger efficiencies

- Expect ~400 Z events for each data slice of 100pb^{-1}
- Can be used rapidly to measure efficiency from data using tag and probe:





Tau trigger MC matching

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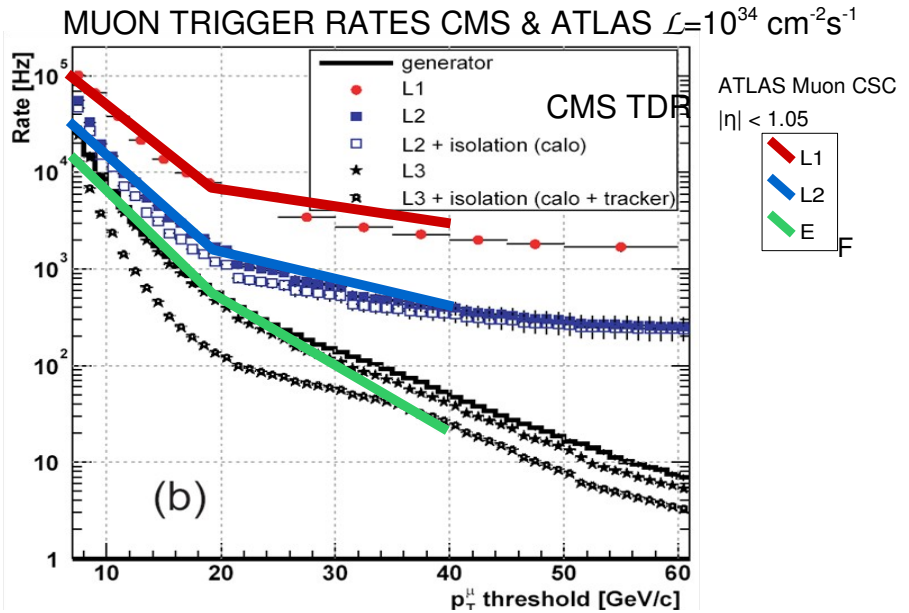
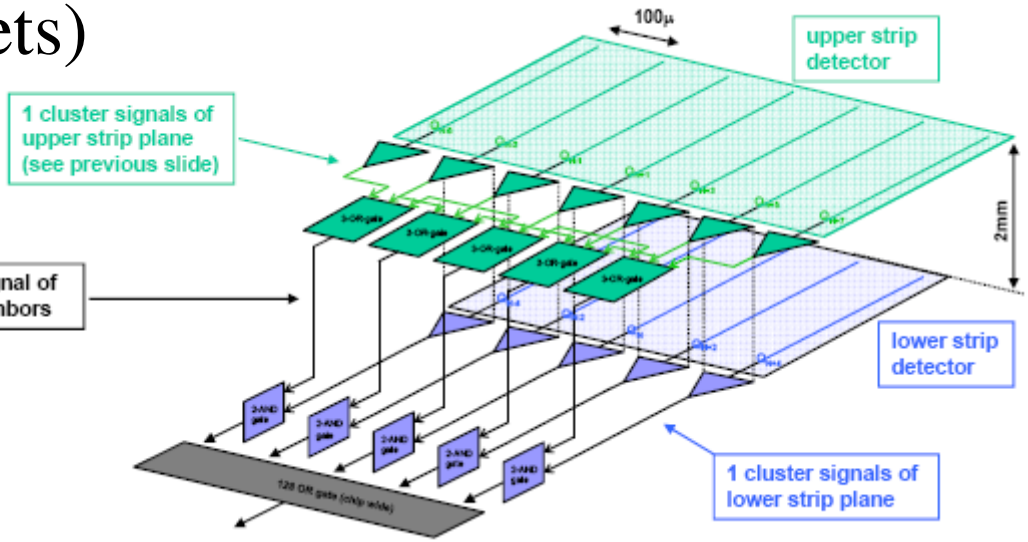
- Early trigger work relies on MC simulation: distributions of MC events must be made to match data (when it arrives) as rapidly as possible in the variables used by the τ trigger
- Using a mixture of MC events from all samples expected to contain many τ's and jets
- Currently studying variable correlations in MC, weighting of events on a histogram-by-histogram basis and on an event-by-event basis

Track trigger for SLHC

- Goals:
  - Improve L1 muon trigger by adding tracking information
  - Secondary vertex trigger
  - Particle multiplicity trigger
- Development
  - Detector module design that select high pT tracks (tracklets)
  - Logic for track trigger
- Tools
  - H8 testbeam with Morpurgo magnet





Grid activities I

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- We participate in numerous grid development projects, including
  - NorduGrid
  - SweGrid
  - Nordic Data Grid Facility (NDGF)
  - KnowARC
  - NGin

Grid activities II

- Development and maintenance of NorduGrid ARC client tools
  - ngsub, ngstat, ... (current stable release)
  - arcsub, arcstat, ... (new development release)
- Storage Gateways
  - access to 3rd party storage systems through ARC
- Availability monitoring tests of ARC enabled computing resources
- ATLAS tier2/tier3 cluster (grad.uppmax.uu.se)

Summary

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- "Finalizing" DØ: ME-Method, indirect H+ searches
- "Starting" ATLAS: Direct and indirect H+ searches
- "Never-ending": Services / techniques / tools:
  - trigger studies, tau-id optimisation, background modeling
  - Very active Grid maintance and development
- And into the future:
  - CLIC development at CTF3
  - Track trigger studies for SLHC